

cycles.



—A MONTHLY REPORT

October 1952

FOUNDATION FOR THE STUDY OF CYCLES

New York, New York

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cycles

—a monthly report

*The Official Bulletin of
the Foundation for the
Study of Cycles*

VOLUME III NUMBER 8 OCTOBER 1952

The Director's Letter

Dear Member:

Please Ask for Help

Can you tell me why it is that almost everybody seems to scorn help when it comes to the matter of detecting and isolating cycles?

I am always running across work that has been done by corporations or individuals—often our own members—without benefit of the help or suggestions that we would so gladly give.

I cannot believe that this policy of self-sufficiency arises from a disinclination to pay a fee. First of all, unless a considerable amount of work were involved, there would be no fee. Second, even companies who pay sizable annual dues and are entitled to a certain amount of free service rarely avail themselves of this privilege.

In most instances of which I am aware a great deal of time and work could have been saved and improved results achieved if our assistance had been invoked before the study was commenced or during its prosecution.

If you are in the process of conducting studies in regard to cycles or plan such studies, won't you therefore please call upon the Foundation for assistance? If the assistance required can be given in a reasonable amount of time there will be no charge. If a large amount of time is required you will be advised of this fact and of the charges before the work is undertaken.

A Little Knowledge

The other day in reading a book called *Male and Female** by Margaret Mead, Associate Curator of Ethnology, American Museum of Natural History at New York, I came across some sentences that apply so particularly to the study of cycles that I would like to quote them here:

"A little learning is a dangerous thing.' Anything that any of us can say about contemporary cultures [and cycles, I might add] is only a very little. It is partial, inadequately formulated, incomplete—as is all science, especially in its beginnings, and always so in periods of new growth. But very few of those who have followed the history of medicine, from the first trepanning operation to the modern transplantation of the cornea, would agree that we should have abandoned medicine because at each stage in history first attempts at operations have been unsuccessful. A little learning, if it is the first learning, is the way in which men move on to new knowledge, and it can be regarded as dangerous only when practitioner or patient overestimates it...

"...if men had said the best surgeon, using his skill to the limits of his experience, might not try a new operation,

**Male and Female*, copyright 1949 by Margaret Mead, published by William Morrow and Company, New York City.

or that a new drug developed under the best protective experimentation that man knew could never be given—then medicine could never have developed. The danger lies always in the practitioner who overestimates his actual knowledge rather than courageously and humbly, knowing that he does not know, takes, with the patient's full knowledge and consent, that patient's life in his hands. The danger lies in the patient who overestimates the physician's skill, and trusts him even where the physician himself has said, 'This is a place for faith but not for trust.' Responsible behavior on the part of those who use the methods of science in any way that affects the lives of their fellow-men consists in recognizing, as fully as they

themselves are able, the meaning of what they do...

"Learning is not dangerous because there is only a little of it, but it is dangerous not to know just how little there is."

What is Ahead in the Stock Market?

I am hopeful that you will find some practical information in regard to stock market behavior in the following article by Veryl Dunbar and in the comments by me which follow it.

Many articles, such as my recent article on the three-year cycle in stock market prices, are of little use unless they are combined with other information. In Dunbar's article, however, you have a presentation that stands on its own feet.

Very cordially yours,

Edward R. Dewey
Director

Research

The Bull Market

A 46-Month Cycle Indicator Sees Its End This Year

By VERYL L. DUNBAR

FOR 119 years a cycle in stock market prices averaging 46 months from one high to another, and from one low to the next, has continued to operate with an accuracy rating of 97%. If this indicator of price movements lives up to its past performances, the year 1952 will bring to a close the bull market which began in 1949. A bear market will follow with a low due in 1953.

This rhythm in the movement of common stock prices has been observed in a study of prices back to 1834. The study was based on the Axe-Houghton Index of Industrial Stock Prices for the years 1883 to date, extended back to 1854 by Clements and Burgess as published in *The Annalist* in June, 1940, and connected with an index of stock prices beginning in 1834 as published in the *Review of Economic Statistics* for August, 1928. The resulting index affords a picture of the movement of prices for a period of 119 years, showing the monthly high and low in each year.

Index Variations

Three facts should be kept in mind with respect to any index of stock prices. First, that two indexes of prices will show

some slightly different results with regard to the month or year in which the absolute high or low in a movement occurred. Second, the movements of industrial stock prices and railroad stock prices are not always homogenous. Third, the prices of individual stocks do not always follow the pattern of its group index. Any well constructed index will nevertheless show the main trend of prices, which is the main consideration here.

While this index starts with the year 1834, an annual index of railroad stocks beginning in 1831 shows conclusively that stock prices reached an important high in 1833 and dropped to a low in 1834. It is possible therefore to trace the recurrence of the 46-month cycle starting with the 1834 low. Since that time this cycle has made 30 complete revolutions for a total of 30 tops and 31 bottoms. In only two instances did the index of prices fail to reach a higher level in the year in which the top of the cycle was reached than in the preceding low year of the cycle. In one other case the percent of advance was negligible as measured by this particular index of prices.

Unusually remarkable, however, is the fact that the index was lower in every instance in the year in which the bottom of this cycle was reached than it was in the preceding crest year of the cycle. The last crest

in this cycle occurred in 1948 with a bottom in 1949. The next high is due in 1952 with a low in 1953. A rhythm which has correctly forecast 59 market movements out of 61, for a period of over 100 years, cannot be disregarded by prudent investors irrespective of their general views on cycle theories.

The table presented above shows the years in which this cycle reached its tops and bottoms. It will be noted that contrary to the usual conception of cycles, the apex does not fall equidistant between two lows, but instead occurs in the year immediately preceding a low. In the 30 completed revolutions of this cycle since 1834 there was a total appreciation in stock values of 2,092% from each low to the next high, or an average advance of about 70% for a bull market swing. A total depreciation in values of nearly 919% is shown for the declines from each high to the next low, for an average decrease in prices of approximately 31% for each bear market reaction. In one complete cycle, stock prices advanced 70% and then declined 31% on average for a total change slightly in excess of 100% for each 46-month period.

In comparing the percent of advance with the percent of decline it should be remembered that 1% of decline results in a larger monetary amount than a 1% advance in the preceding

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STATISTICAL EVIDENCE OF A 46-MONTH CYCLE IN COMMON STOCK PRICES

(Based on the *Axe-Houghton Index of Industrial Stock Prices for the years 1883 to date, carried back to 1854 by Clement and Burgess, and connected with an index of stock prices from the year 1934 as published in the Review of Economic Statistics. The index shown for each year is the index for the month in which the high or low occurred in that particular year).*

Cycle Low		Cycle High		% Appreciation Low to High	% Depreciation High to Low
Year	Index	Year	Index		
1834	17.2	1837	22.0	27.9	37.7
1838	13.7	1841	12.2	(1.1)	38.5
1842	7.5	1845	17.5	133.3	5.7
1846	16.5	1849	19.0	15.2	6.8
1850	17.7	1853	27.0	52.5	40.0
1854	16.2	1856	21.2	30.9	57.1
1857	9.1	1860	19.0	108.8	36.3
1861	12.1	1864	37.5	209.9	37.1
1865	23.6	1868	39.7	68.2	20.4
1869	31.6	1872	46.8	48.1	42.7
1873	26.8	1876	39.6	47.8	36.4
1877	25.2	1879	49.0	94.4	12.2
1880	43.0	1883	59.4	38.1	45.1
1884	32.6	1887	73.6	125.8	19.6
1888	59.2	1891	78.4	32.4	6.4
1892	73.4	1895	70.0	(4.6)	37.1
1896	44.0	1899	94.8	115.5	30.8
1900	65.6	1902	102.4	56.1	35.0
1903	66.6	1906	135.4	103.3	46.5
1907	72.4	1910	131.8	82.0	30.0
1911	92.2	1914	111.6	21.0	14.2
1915	95.8	1918	162.5	69.6	14.0
1919	139.7	1922	160.4	14.8	19.8
1923	128.6	1925	198.6	54.4	25.2
1926	148.5	1929	428.8	188.8	64.1
1930	153.8	1933	154.2	0.3	26.9
1934	112.7	1937	293.4	160.3	57.5
1938	124.8	1941	170.0	36.2	29.4
1942	120.0	1945	280.4	133.7	21.4
1946	220.4	1948	283.0	28.4	24.7
1949	213.0	1952	?		
1953	?	1956	?		
Total				2092.0	918.6
Average percent of change for the 30 recurrences of this cycle				69.7	30.6

() Denotes decrease.

rise. To illustrate, the index shown in the table increased from 65.6 in 1900 to 102.4 in 1902 which was an advance of 56.1%. However the decline from 102.4 in 1902 back to 66.6 in 1903 (approximately the same level as in 1900) amounts to only 35%. The maximum depreciation in values is 100%. The maximum appreciation in values is supposedly infinite.

Those familiar with the price movement throughout the years will recognize the fact that the years shown in the table do not always coincide with the year in which the absolute high or low occurred in a major bull or bear market. For example, while the 1929 high does coincide, the 1932 bear market low does not since the 46-month cycle ended in 1930. In practically every instance, however, the low year of the cycle has marked the end of a major bear movement. While other factors are undoubtedly involved in the changes in stock prices, it is the intention here to consider only the presence of the 46-month periodicity

in the fluctuations of the market. Similarly, no attempt will be made to determine the exact period of this cycle here, except to state that it has averaged about 46 months from low to low and from high to high.

Actually the cycles recur at intervals of 3-4-4-4-4 years and then repeat with six cycles recurring in a period of approximately 23 years, twelve in 46 years, etc. It is interesting to note, however, that rhythms of about 23 years and 46 years have been observed in other phenomena. Regardless of the exact period of time involved, the fact that this cycle has continued for at least more than 100 years raises the question as to whether these recurrences can be the result of random forces only. The real test of any cycle is whether it continues to operate after it is discovered. The 46-month cycle was first observed by this writer in 1947. It continued to operate in 1948, and again in 1949. Other indications at the present time suggest that it may do equally well in forecasting

the price movements in 1952 and 1953.

The value of any cyclical aid in timing stock transactions is determined only by its actuarial probabilities. How many times has the cycle recurred, and over how long a period of time? How accurate has it been in forecasting the trend of prices? And what was the percent of appreciation and depreciation in the values of stocks in each completed cycle?

It is apparent therefore that the 46-month cycle rates as a very good risk on an actuarial basis. It has recurred 30-31 times in a period of 119 years. It has been accurate 97% of the time. It has pointed the way to an average appreciation of 70% in the value of stocks during bull markets. It would have been possible on the basis of past records for an investor to make an average gain of 100% every 46 months from a combination of both the long and short sides of the market.

Since no one will ever catch the absolute highs and lows at the turning points in each market, the possibility of such a gain is of course purely theoretical. The probability of gaining from 75%-80% should be realistic enough and this would net an average return of about 20% per year, which should satisfy the most optimistic investor. In this connection, the experienced investor does not have to be told that he must be prepared to take occasional losses along with the gains regardless of his formula for investing. The net result over a period of years is the important thing.

Will this cycle continue to operate in 1952 and 1953? Only time will answer that question, but the past record of the 46-month cycle suggests that the wary investor may want to give thought now to the warning being sounded by this indicated timer of market movements.

WILL DUNBAR'S CYCLE STAND UP?

By Edward R. Dewey

IN my opinion the 46-month cycle in industrial common stocks, discussed by Veryl L. Dunbar on pages 265 and 266 of this report, is real. I feel that it throws light upon the probabilities of the future, and that it must be taken into account in connection with any attempt to forecast the future of stock market prices.

As Dunbar makes clear, he figures his gains from the level of the lowest month in the year of cycle low to the level of the highest month in the year of cycle high (or vice versa) according to a pattern of 3-4-4-4-4 years and repeat.

This is a perfectly legitimate way of figuring, but requires you to pick the lowest and highest months of the year in question, if you are to realize the indicated profit.

Dunbar's Forecast Paraphrased

His forecast then may be paraphrased and expanded thus:

"If the patterns of 119 years prevail, 1952 will be a year of high, 1953 will be a year of low.

"Percentage declines from the high month of years of high to the low month of years of low (the year next following), arranged in order of size, have, in the past, been as shown in Table 1.

"That is to say, there is certain to be a decline, unless the precedent of 119 years is broken. This decline may run anywhere from 5.7% to 64.1%.

"Assuming the continuation of the pattern, the odds are slightly better than 50-50 (16 to 14) that the decline will be at least 19.8% and not over 38.5% (see bracket called majority range); and the odds are 2 to 1 (20 to 10) that the decline will be at least 14.2% and not over 42.7% (see bracket called 2/3 range)."

As this article is being written we do not yet know the value of the high month of 1952, but on January 1, 1953 you will know it. At that time you can apply the above percentages to give yourself the probable values of the low month of 1953.

A Diagram

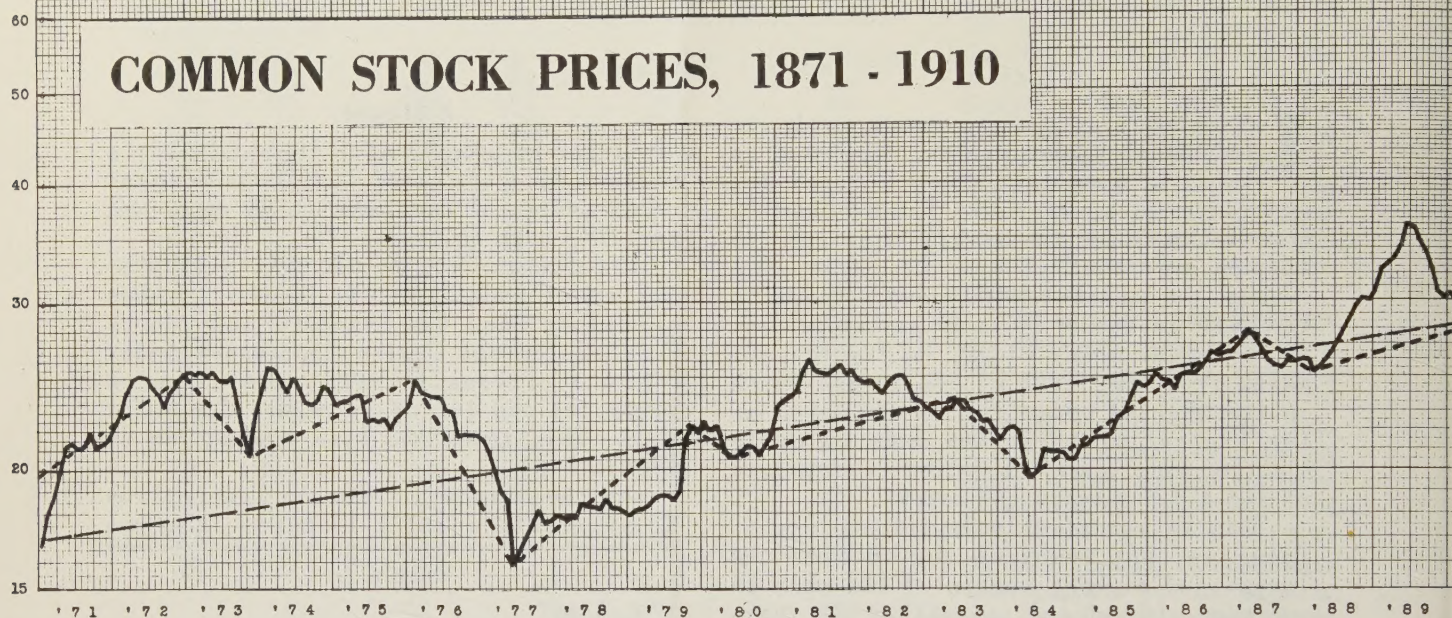
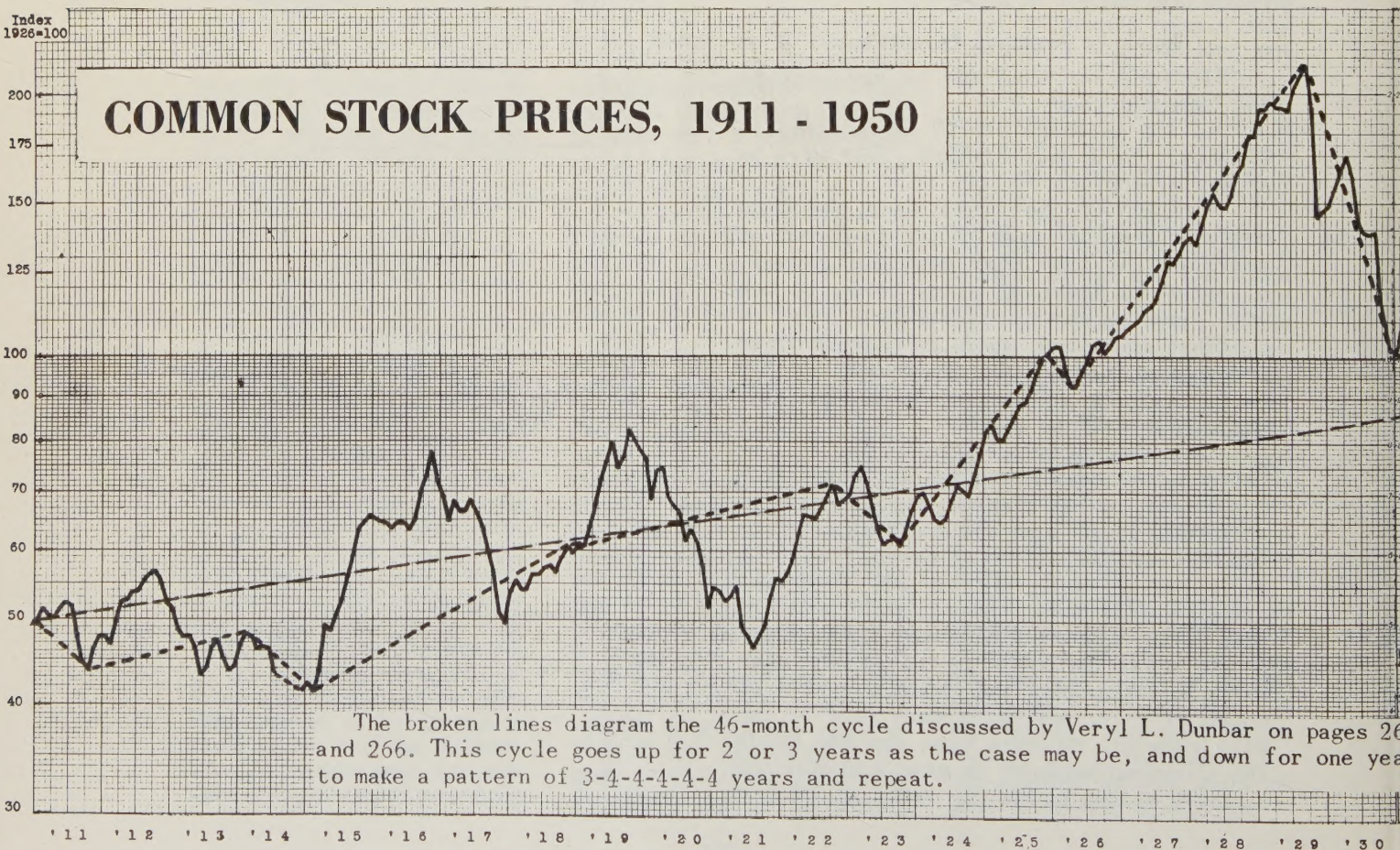
It may be helpful if I diagram Dunbar's cycle upon a chart of industrial common stock prices. I have done so on pages 268 and 269, next following.

Unfortunately I do not have available the exact index used by Dunbar. I have therefore used the Standard and Poor's Corporation and Cowles Commission Index which I originally printed for you on pages 144 and 145 of my report for April 1951. This index has been brought up to August 1952.

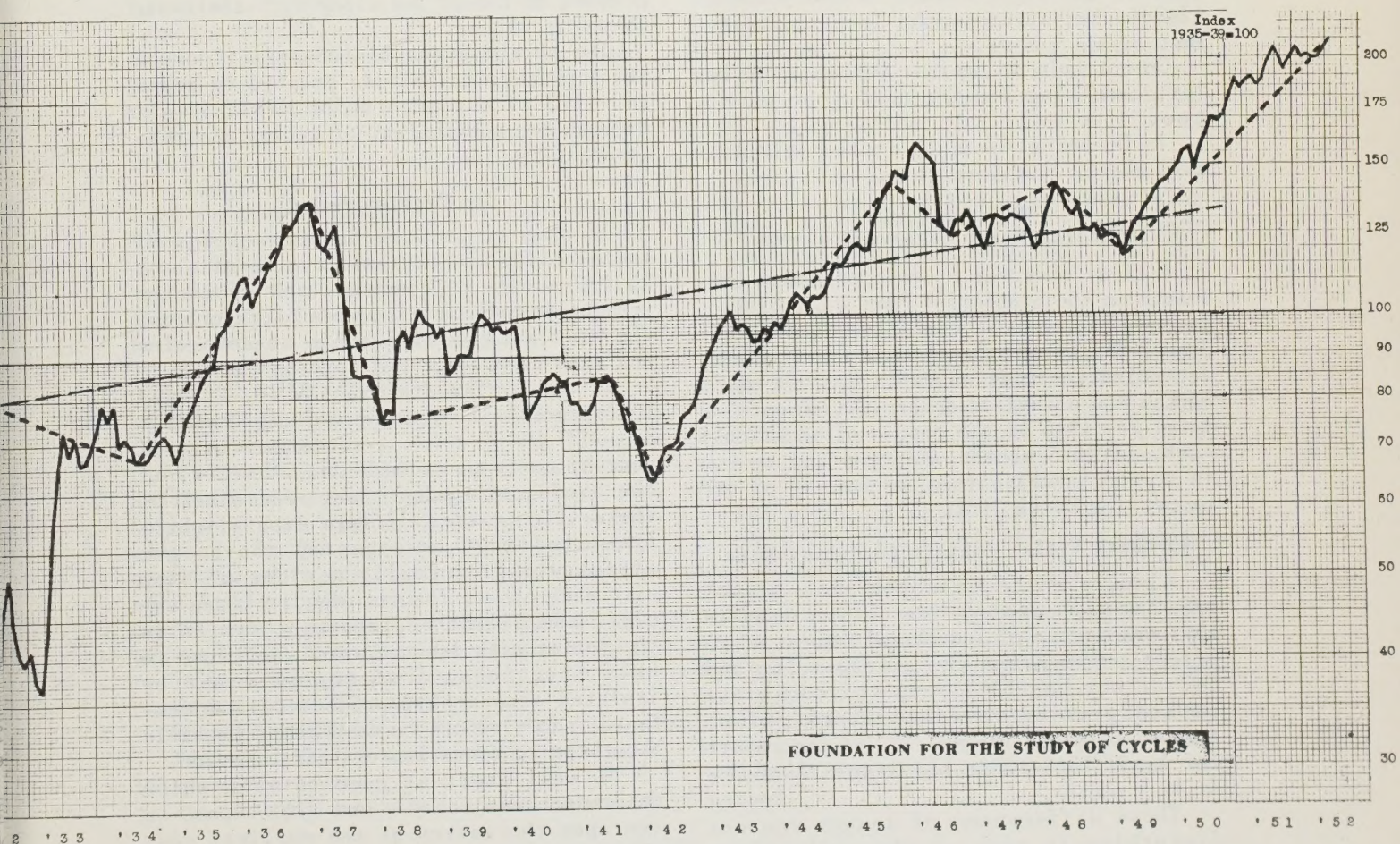
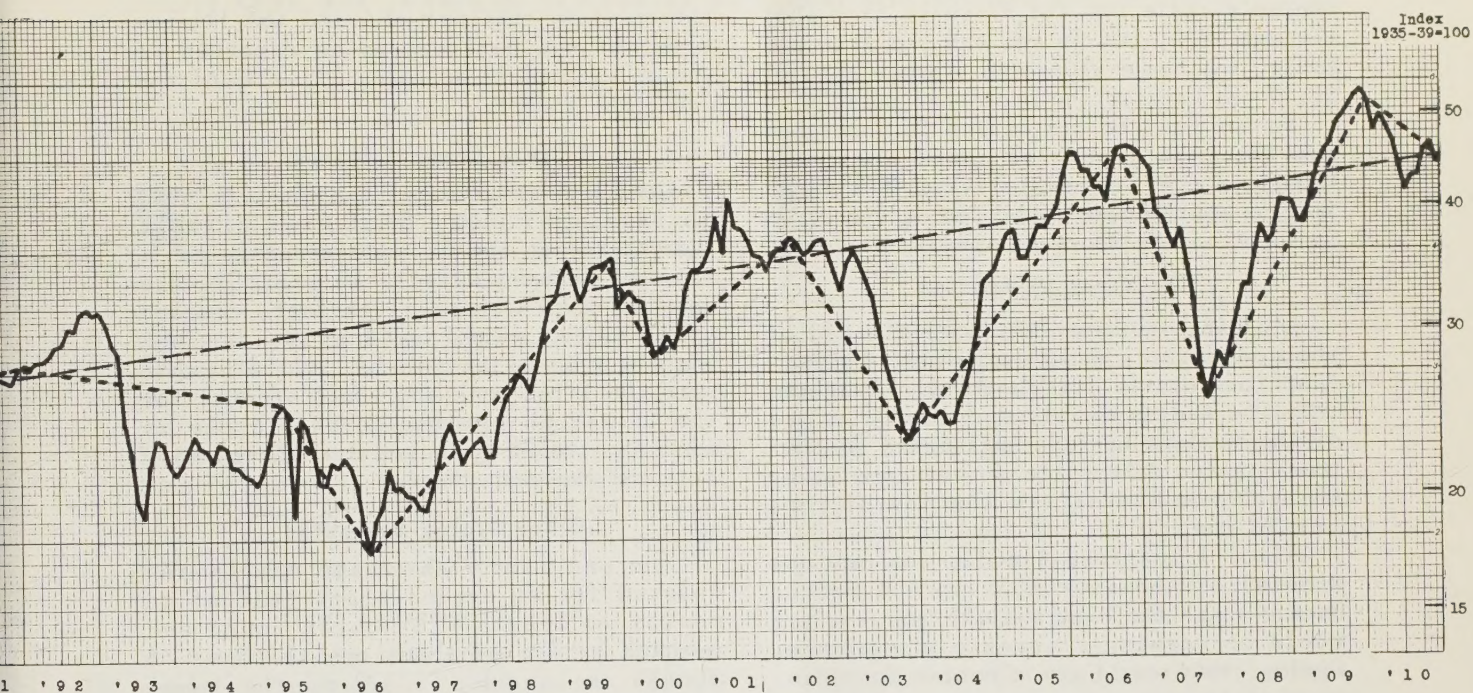
As the Standard & Poor's Corporation index starts in 1871 I cannot show you

Table 1.

Percent Decline			
5.7			
6.4			
6.8			
12.2			
14.0			
14.2			
19.6			
19.8			
20.4			
21.4			
24.7			
25.2			
26.9			
29.4			
30.0	Typical or Median	Majority Range	2/3 Range
30.8			
35.0			
36.3			
36.4			
37.1			
37.1			
37.7			
38.5			
40.0			
42.7			
45.1			
46.5			
57.1			
57.5			
64.1			

Index
1928=100**COMMON STOCK PRICES, 1871 - 1910**Index
1928=100**COMMON STOCK PRICES, 1911 - 1950**

'11 '12 '13 '14 '15 '16 '17 '18 '19 '20 '21 '22 '23 '24 '25 '26 '27 '28 '29 '30



Dunbar's cycle for the 37 years from 1834 through 1870, but as you can see from his table, the cycle showed an average gain of 51.4% per transaction over that period.

Dunbar will be criticized for not giving the exact month of ideal crest and trough. The criticism is valid, but I can imagine that Dunbar might remind you of an incident in the story of Aladdin's lamp.

The Story of Aladdin

Aladdin, you remember, with the aid of the good genii, had, overnight, built a sumptuous castle for the King's daughter. Only, he had expressly provided that one of the windows be left unfinished so that the King could have the fun of completing the job and sharing in the joy of construction.

Also, I imagine, Aladdin was not unmindful of the fact that in the months during which the King and all his jewelers would be working to create the missing window, they would get a better appreciation of the significance of the job that Aladdin had already done in building the rest of the castle.

Do not hold it against Dunbar if he has left something for the rest of us to do, too.

Is Dunbar's 46-month cycle real? As I said above, I believe it is.

46-Month Cycle in Stocks First Observed in 1944

I first observed a cycle of about this length in the Standard & Poor's Corporation Index of all stocks combined, June 1871—June 1943. My worksheets show a preliminary determination made on March 6, 1944 of 45 months and a revised determination made on April 24, 1944 as the result of additional work, of 45.5 months. We reported to you in regard to this cycle on page 88 of our report for March 1951.

46-Month Cycle Appears in Periodogram

Also, a cycle of about this length (46.4 months) appears very importantly in the periodogram of industrial common stock prices printed for you on pages 166 and 167 of our May 1952 report, and in the periodogram of railroad stock prices printed on pages 126 and 127 of the report for April 1949 where the length looks to be 46.9 months.

These differences of length are not disturbing in view of the preliminary

nature of my original work and the limitations of the periodogram as reported to you in an article on pages 229—232 of the June 1951 report.

Cycle Seems M Shaped

Casual observation of the chart printed on pages 268 and 269 of this article indicates that the 46-month cycle is not a simple $\wedge$ shaped affair, but that it has more of a M shape. This fact, coupled with trend, would naturally make the second peak of the double cycle higher than the first peak and would account for the fact that trading on this cycle is more profitable when you are three years long and one year short.

Other Cycles Suggested

The peculiar M shape may be accounted for by cycles about half of 46 months in length (23 months long) and perhaps by cycles about one third of 46 months in length (15 $\frac{1}{3}$ months long) present in the series along with the basic 46-month pattern.

The periodograms of industrial common stock prices, by thirds, printed on pages 169—173 of our report for May 1952 all suggest the possibility of cycles of these lengths.

The Problem Ahead

If this conjecture is correct and if there really are rhythmic cycles of about 15 $\frac{1}{3}$ months, 23 months, and 46 months present in industrial common stock prices, the next step is to isolate these cycles and then to project and combine them.

If the cycles are exactly 46, 23, and 15 $\frac{1}{3}$ months long and continue, Dunbar's 3 - 4 - 4 - 4 - 4 - 4 sequence will, of course, continue permanently. However, if the average length of one or another of these three cycles differs even slightly from the lengths suggested above, the cycles will eventually get out of step with each other. That is why the three cycles, and all other important cycles in the series with lengths which are close to unit fractions of 46 months, must be isolated separately, projected, and combined before we can be as sure as possible about the continuation of this behavior.

We will start at once to make these determinations for you and will report to you upon the matter at the earliest possible moment.

THE 13-YEAR CYCLE IN AUTOMOBILE SALES

By Edward R. Dewey

WE are just at the crest of a 13-year cycle in the sales of passenger automobiles. If this cycle is real and continues it will exert a depressing effect upon the automobile industry for the next six or seven years, after which the cycle will provide six or seven years of lift.

However, the depressing effect of any 13-year cycle which may be present in these figures is not likely to be noticed until after 1954 because the six-year cycle can be expected to exert an upward force until that time.

First Recorded in 1950

I called your attention to the 13-year cycle in automobile sales in our report for October 1950. At that time I estimated, from inspection, that the length might be 11 or 12 years. However, a study just completed shows that the length of this cycle is probably a little longer.

I say "probably" because in a series of figures as short as this one, relative to the length of a 13-year cycle, the wave length cannot be determined with assurance. Also, the very rapid rate of growth of this industry from 1893 to 1915 makes calculation of wave length quite difficult. The length of 13 years must, therefore, be thought of as an approximation.

Too Few Repetitions

Moreover, when we have as few repetitions of a cycle as we have of the 13-year cycle in these figures the cycle may easily be the result of random forces. We have no way of knowing until more time has elapsed. In the meantime, you should accept this cycle, with your fingers crossed, on a purely conjectural basis.

As nearly as can be determined at the present time, the characteristics of this cycle have been as follows:

Wave length: 13 years.

Overall amplitude: 67% of trend

Typical time of crest: 1900 and every 13 years thereafter.

This timing puts the current crest of

this cycle ideally at mid-1952, the next ideal trough of this cycle at the end of 1958.

The Charts

Fig. 1 shows the actual year-by-year factory sales of automobile passenger cars from 1893 through 1951.

Fig. 2 shows these figures smoothed by a 3-year moving average and also shows, by means of a dotted line, their six-year moving average. A cycle of about 12-years in length appears by inspection of the six-year moving average.

Fig. 3 shows a six-year geometric moving average (solid line) and an 11-year geometric moving average (dotted line).

Fig. 4 shows the percentage deviations of the six-year geometric moving average from the 11-year geometric moving average. From these percentages it is clear that the cycle is about 13 years long.

Figs. 1 to 4 inclusive are plotted on ratio ruling so that the cycles will be of comparable size.

Adjusting for the effect of the 13-year cycle we find that the underlying pre-war trend of factory sales of passenger automobiles was about level at 3,000,000 cars a year.

Two Cycles

The two chief cycles of automobile sales are the six-year cycle and the 13-year cycle. Combining these two cycles with the trend, we can easily make a projection into the future as shown by Fig. 5, plotted on arithmetic scale.

The upper curve in Fig. 5 represents the six-year cycle which has repeated itself enough times so that it may be thought of as probably real.

The second curve represents the 13-year cycle, which has been present since the beginning of these figures, but perhaps merely as a random tendency.

The smooth line represents trend as it was pre-war. We cannot tell where trend really is now until things get back to "normal."

Number of
Passenger
Automobiles
10,000,000

1,000,000

100,000

10,000

1,000

100

10

1890
1900
1910
1920
1930
1940
1950
1960

World War I

World War II

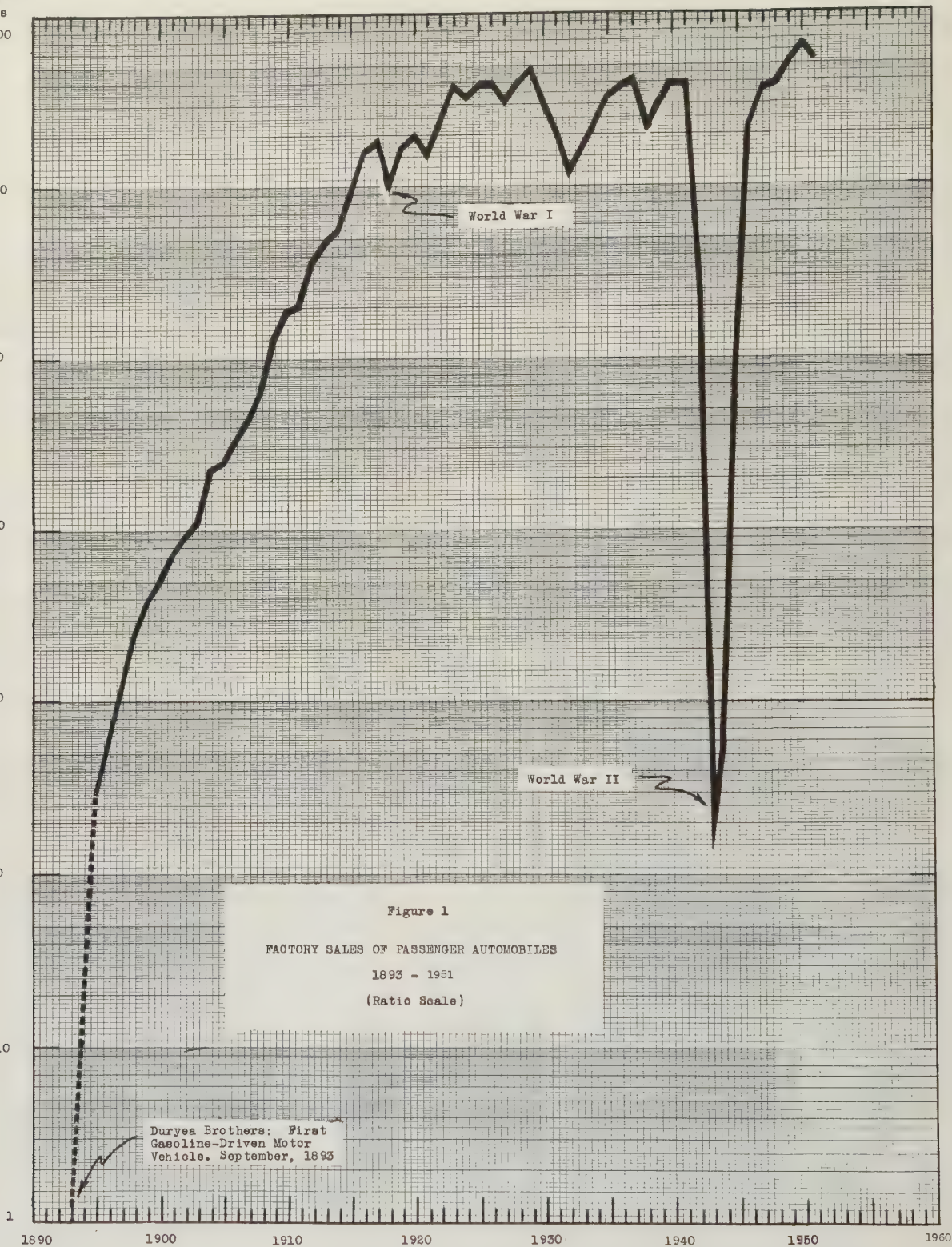
Duryea Brothers: First
Gasoline-Driven Motor
Vehicle. September, 1893

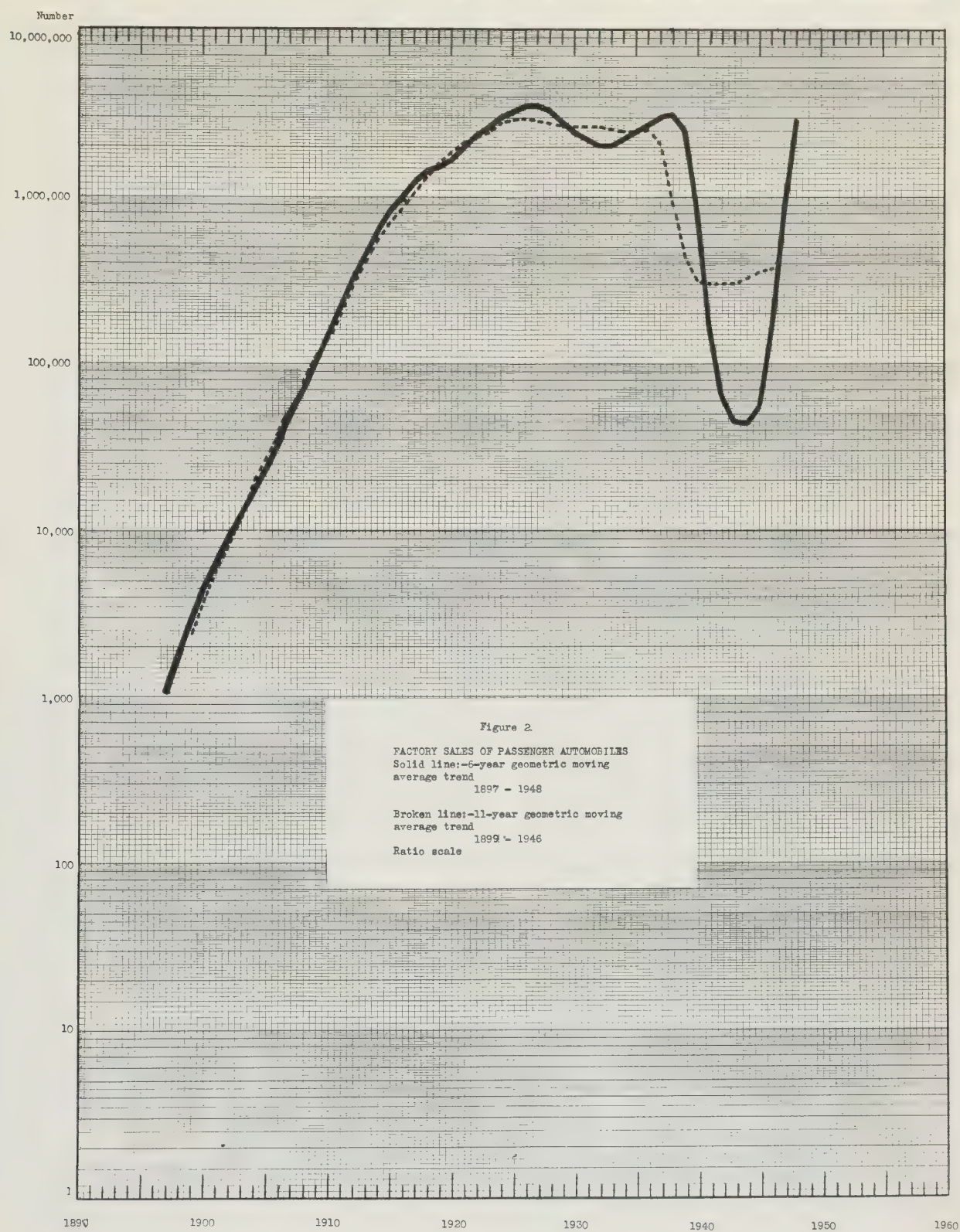
Figure 1

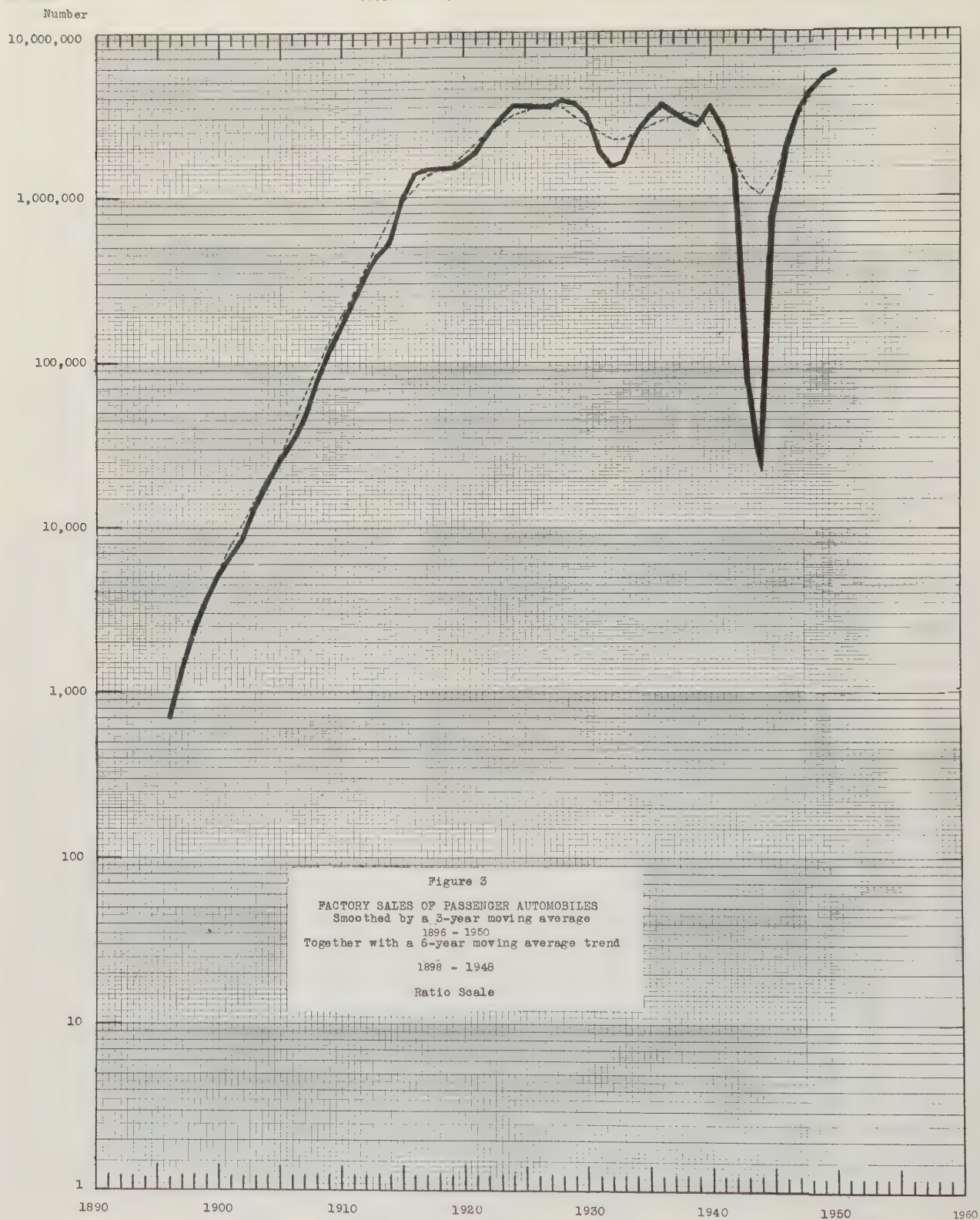
FACTORY SALES OF PASSENGER AUTOMOBILES

1893 - 1951

(Ratio Scale)







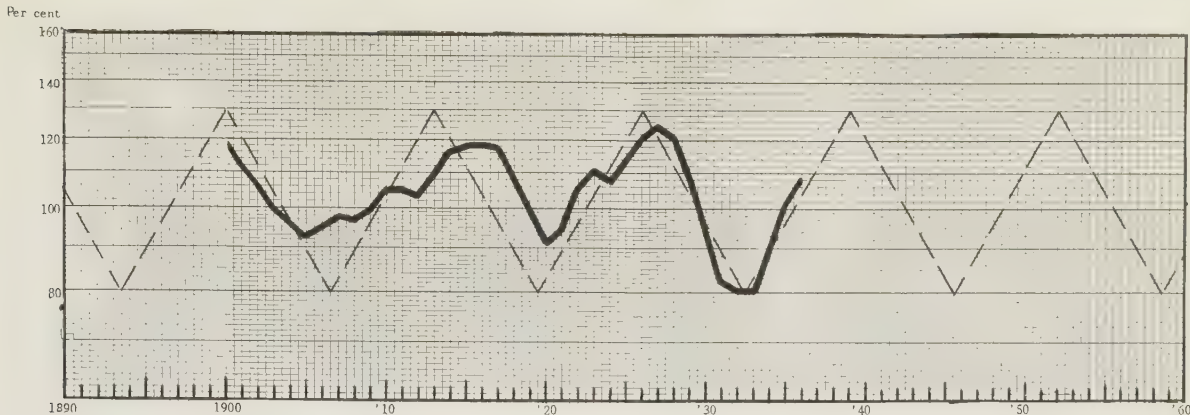


Fig. 4. THE 13-YEAR CYCLE IN THE FACTORY SALES OF AUTOMOBILES.

This chart shows the difference between the 6-year geometric moving average and the 11-year geometric moving average. A 13-year cycle appears clearly, and is diagrammed by a broken line. There are however not enough repetitions of this cycle to be sure that it may not have come about as a result of random forces. The curve stops in 1936 because war distortions make later comparisons meaningless, even though war and post-war behavior do happen to fall into the 13-year pattern. Patio scale

A Projection

Below the smooth line is the synthesis or combination of the trend and the two cycles, together with a chart of the actual figures.

If you compare the synthesis and the actual behavior up to and including 1941 you will note general agreement between the two sets of figures. This is to be expected because the six-year and 13-year cycles have, without any question whatever, been present in this series of figures. (The question is not whether these cycles have been present, but whether or not their presence is significant. That is, can they be expected to continue.)

On the assumption that the cycles are real and that there has been no change in the pre-war trend, it is easy to project probable future behavior as far into the future as we wish. This has been done in Fig. 5 by means of a broken line.

War Deficiency and Post-War Surplus

From 1942 through 1945 the war caused an almost complete cessation of passenger car production, producing the deficit shown by the shaded area on Fig. 5, between the solid line representing actual sales and the broken line representing the projection.

It is seen that from 1947 on the sales

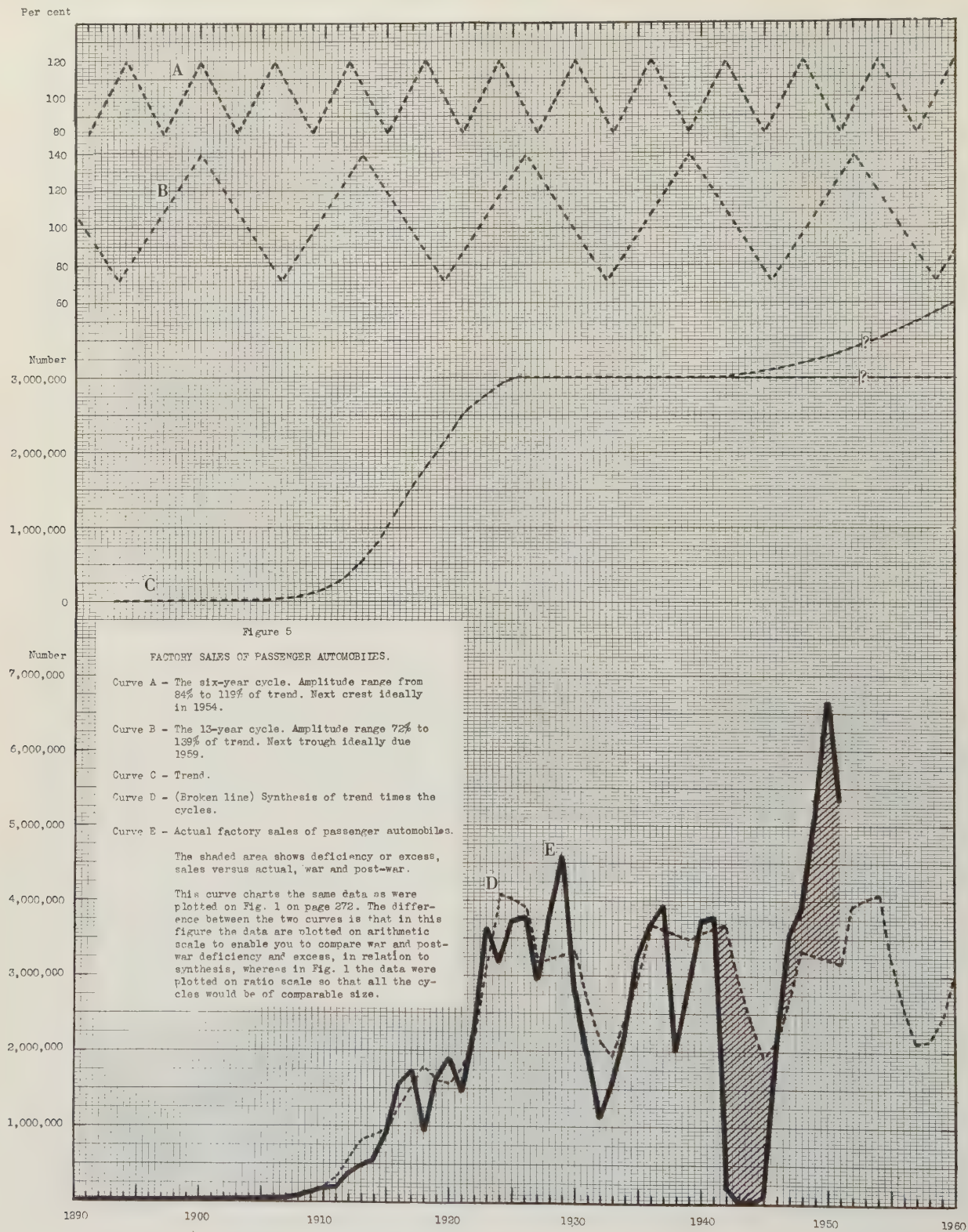
have been above the projection and that the total excess (also shaded) is about equal to the previous deficiency.

Future Revisions

Figures of factory sales of automobiles for the first half of 1952 indicate that sales for this year will not be far from the forecast based on the two cycles and the pre-war trend. If the forecast continues to be fulfilled we can assume that the cycles are real and that the pre-war trend is continuing. On the other hand, if the forecast is not fulfilled we should modify the trend.

Also, come the late 50's (of course, barring war), if there is no serious setback in automobile production for several years, we should begin to suspect that the 13-year cycle present in these figures from 1893 to 1941 was present merely by accident.

Finally, bear in mind that there are short cycles in automobile sale figures, too, so that in the future, as in the past, even assuming the continuation of the major cycles and the trend, the actual year-to-year behavior will vary somewhat from the projection. The projection is for general orientation only, and is to be interpreted and used with the qualification stated above.



AN OLD STUDY OF PIG IRON PRICE CYCLES

We are indebted to one of our members for an interesting article printed 28 years ago next month. It is about the 40-month cycle in pig iron prices.

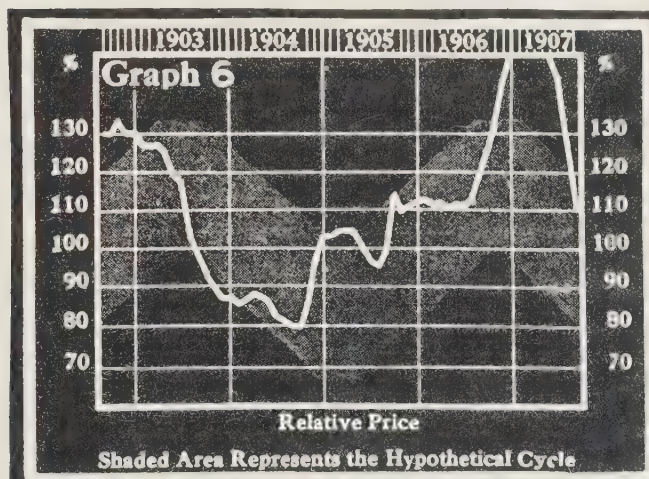
The article was printed in the *Industrial Digest* for Nov. 1924. The "box" read:

"Nineteen months ago this publication presented, for the first time, an exclusive analysis of pig iron prices proving that these prices follow a clearly-defined cyclic trend and forecasting a definite date on which this trend would turn downwards. This was unusual in two respects. First, economists who lean toward particular theories generally prefer to state those theories in Delphic style—capable of considerable elasticity in interpretation. Second, where specific forecasts have been made, the theory seldom coincided with the facts.

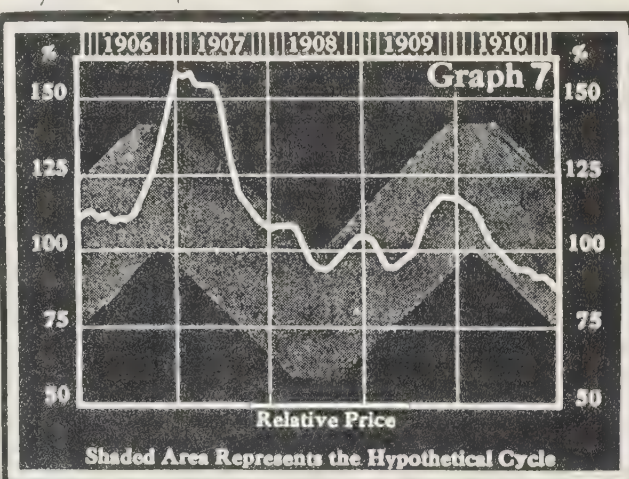
"But in the case of *The Industrial*

Digest's pig iron analysis, the theory and the fact have paralleled each other precisely. The prediction came true, and the cycle has been accepted as authentic by leading iron and steel men. In this issue we present once more, a definite prediction as to the trend of pig iron prices. It is a prediction based on more than 20 years of fact. It concerns every business-YOUR business, for the price of pig iron affects not only the price of all other commodities but also the general course of daily business. It closely concerns your own bank balance. Read it."

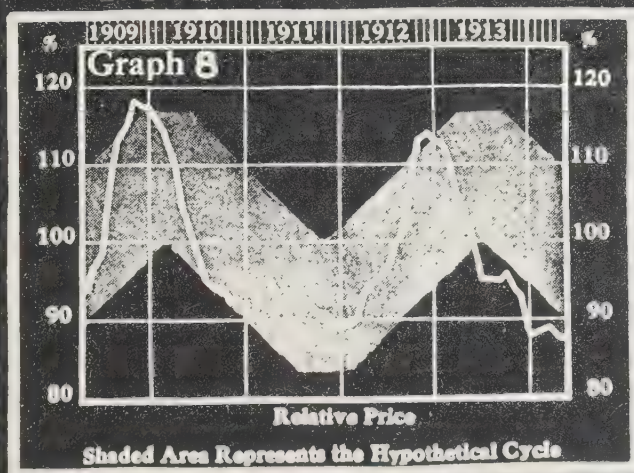
In a future report I will bring these figures up to date to show you how this forecast came out. In the meantime, you may wish to look at a reproduction of some of the charts presented because of the especially good way in which the typical cycle is represented.



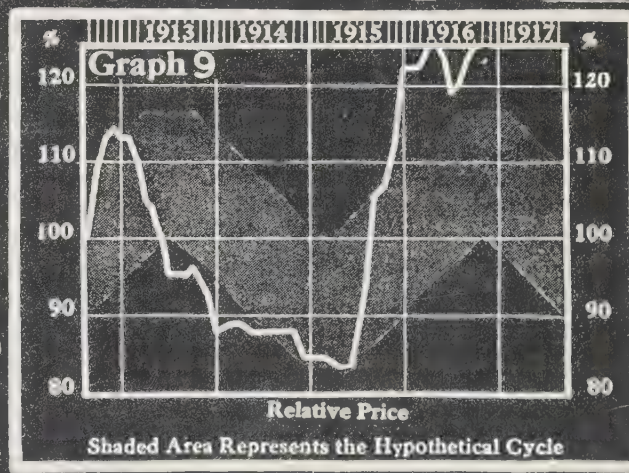
1909-1913 average price = 100



1909-1913 average price = 100



1909-1913 average price = 100



1909-1913 average price = 100

Technical

THE RATIO OR SEMI-LOGARITHMIC SCALE

In a letter printed in the **Letters** section of our September 1952 report I promised a discussion of the ratio or logarithmic scale. In accordance with that promise I am printing herewith the following comments, taken in part from **Cycles—The Science of Prediction**, a book written a number of years ago by Mr. E. F. Dakin and myself.

The solid line in Fig. 3, printed below, shows the sales of a hypothetical business that grew 90 per cent in the first five year period, from 1905 to 1910, 80% in the next five-year period, 70 per cent in the next, and so on. The rate of growth, that is, declines 10 per cent in each five-year period, and falls to a level of 20 per cent in the five-year period from 1940 to 1945.

The curve in Fig. 3 gives little or no **visual** warning of the drastic fall-off in sales that lies immediately ahead (as shown by the broken line in this chart) if the growth pattern continues in the future as in the past. If this pattern does continue, the sales in 1950 will be only 10 per cent more than the sales in 1945, and the sales in 1955 will show no growth whatever when compared to 1950.

In order to make this situation visually clear, many businessmen and students of trends prefer to plot all data pertaining to growth on what is known as a **ratio (or semi-logarithmic) scale**. On such a scale equal vertical distances represent equal **percentage** change.

Let us illustrate by charting the growth of another business using both the arithmetic and ratio scales.

The business starts at a sales volume of \$2,000 a year; the second year it doubles its sales to \$4,000; the next year it doubles again to \$8,000.

On the arithmetic scale these facts would be represented in a chart laid out

as in Fig. 1.

On a ratio scale, the same facts would be represented on a chart laid out as in Fig. 1a.

Notice that on a ratio scale the numbers on the vertical scale represent equidistant percentage values, and come closer and closer together, in a way that interposes the same vertical distance between 4 and 8 as between 2 and 4 (because 8 bears the same relation to 4 that 4 bears to 2).

A straight line plotted on a ratio scale means that the **rate** of growth is constant. (Such a state of affairs, of course, never exists for long in any real situation.)

When the **rate** of growth declines as the business or the organism gets older, this decline is represented on a ratio scale by a bending-over in the line.

Thus, if the business cited here grew from \$2,000 in its first year to \$4,000 in its second year, and then grew an equal **amount**—from \$4,000 to \$6,000—from its second to third year, these facts would be shown on **ratio** scale as in Fig. 2a.

On the other hand, using the arithmetic scale, the line would continue from the second to the third year at the same slope as from the first year to the second, giving no visual suggestion that the rate of growth was declining. The same figures plotted on the arithmetic scale would look as shown in Fig. 2.

Further to compare the difference between arithmetic and ratio scales, the sales of the hypothetical business, discussed first above, are charted in Fig. 3a.

One advantage of such a plotting is that it shows directly the falling off in the rate of growth, and permits making a visual or freehand projection into the future that is much more likely to be fulfilled than any similar projecting of a chart on the arithmetic scale.

Ratio scales are usually labeled as such. If not, they can be recognized from the fact that the numbers on the scale come closer and closer together as they grow larger, as in Fig. 1a & Fig. 2a above; or else, for equal intervals, the numbers get proportionately larger and larger, as in Fig. 3.

The interval from one number—let us say 1—on the vertical scale of a ratio chart to the number ten times higher, in this instance 10, is called a “cycle.” The

same distance is used to represent the next tenfold growth, from 10 to 100, and so on. In reading a curve plotted on ratio scale, one should always look at the vertical scale to see how many cycles are involved.

So that you may make additional comparisons of data charted on ratio and on arithmetic scales, Three other series of figures have been plotted on both ratio and arithmetic rulings, namely Figs. 4 and 4a, 5 and 5a, and 6 and 6a.

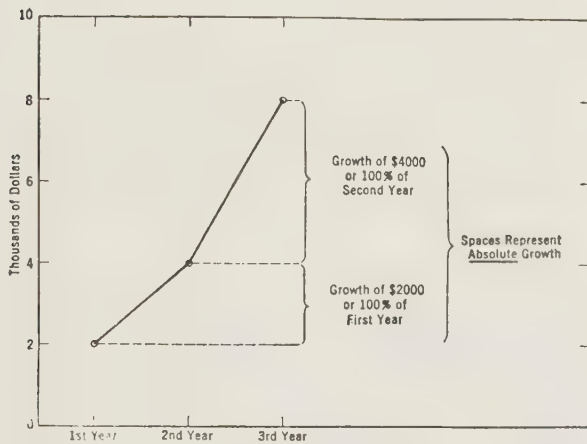


Fig. 1. Equal Rate of Growth—Arithmetic Scale.

Sales of a hypothetical business organization showing constant rate of growth.

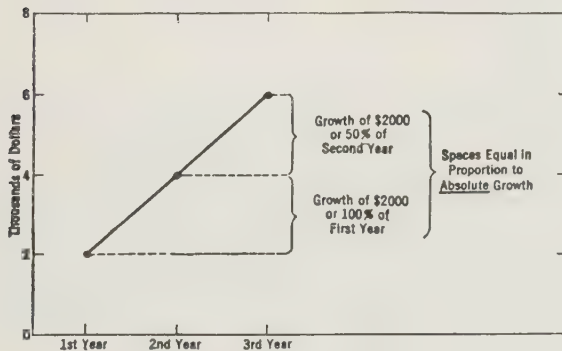


Fig. 2. Equal Amounts of Growth—Arithmetic Scale.

Sales of a hypothetical business organization showing constant amount of growth.

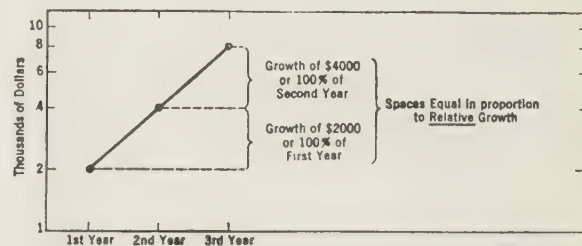


Fig. 1a. Equal Rate of Growth—Ratio Scale
Sales of a hypothetical business organization showing constant rate of growth.

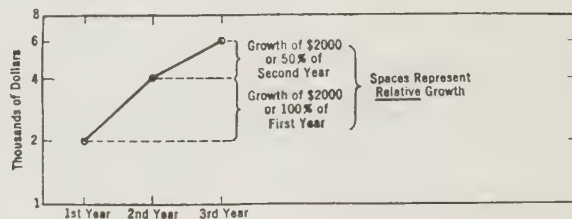


Fig. 2a. Equal Amount of Growth—Ratio Scale.

Sales of a hypothetical business organization showing constant amount of growth. Ratio scale.

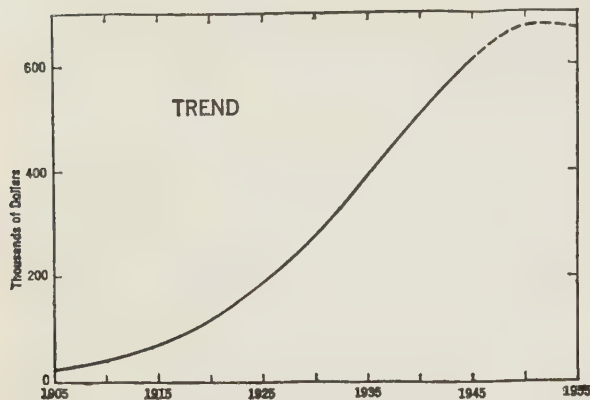


Fig. 3. Trend of a Hypothetical Business Organization

Data—1905-1945, with a projection to 1955. The projection is based on the assumption of a continuation of the constant decline of the rate of growth.

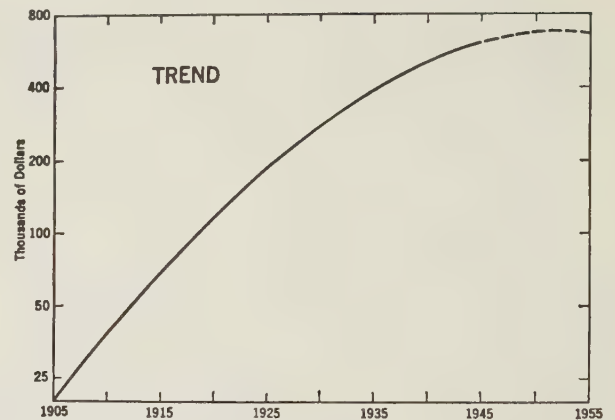


Fig. 3a. Trend of a Hypothetical Business Organization. **Ratio scale.**

Data 1905-1945, with a projection to 1955. The projection is based on the assumption of a continuation in the constant decline of the rate of growth.

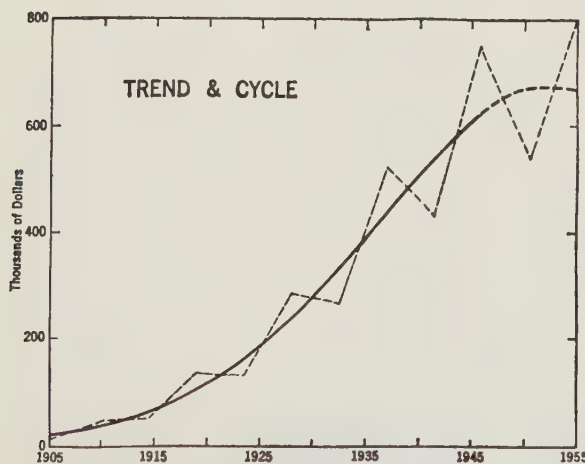


Fig. 4. The Trend and the Cycle

Trend of a hypothetical business organization as shown in Fig. 3 with a regular 9-Year Cycle of 20 per cent amplitude superimposed.

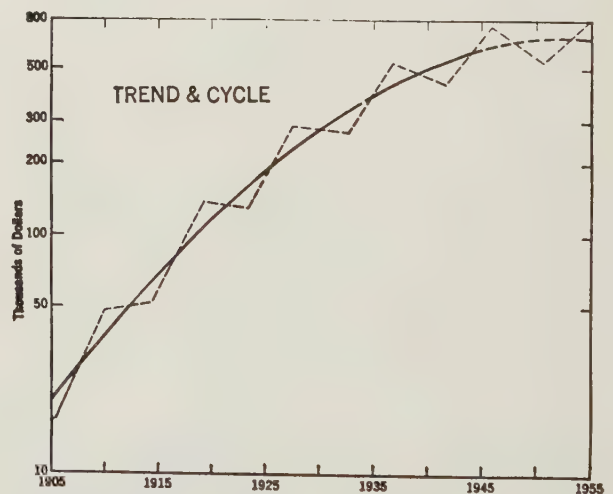


Fig. 4a. The Trend and the Cycle.

Trend of a hypothetical business organization, as shown in Fig. 3, with a regular cycle of 20 per cent amplitude superimposed. **Ratio scale.** Note that when one uses ratio scale, the wave has equal absolute magnitude throughout.

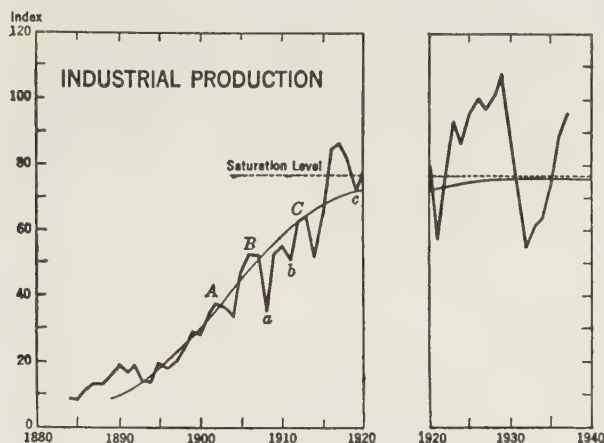


Fig. 5. Growth of Industrial Production in the United States.

Data—1854-1937, together with Trend (after Davis). The chart has been split into two parts to emphasize the changing character of the trend.

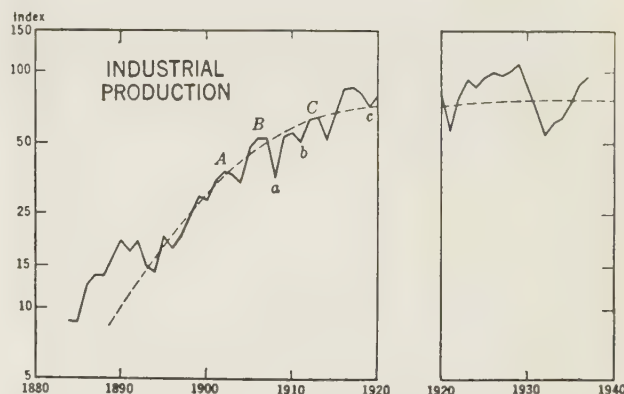


Fig. 5a. Growth of Industrial Production in the United States. **Ratio scale.**

Data 1884-1937, together with trend. (After Davis.) The chart has been split into two parts to emphasize the changing character of the trend.

On ratio scale all booms and depressions are shown in their true relative proportions.

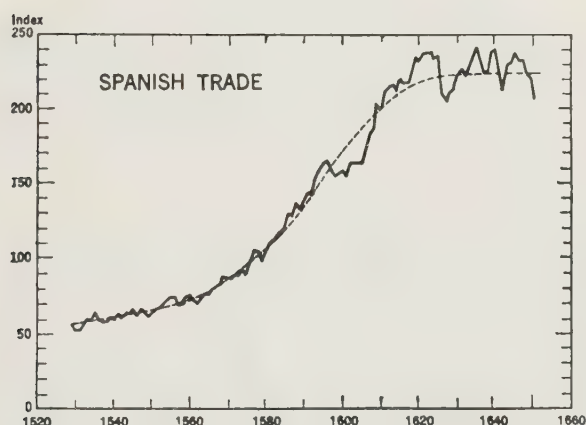


Fig. 6. Index of Spanish Trade.

Data—1530-1650 (after Davis and Hamilton) together with Trend.

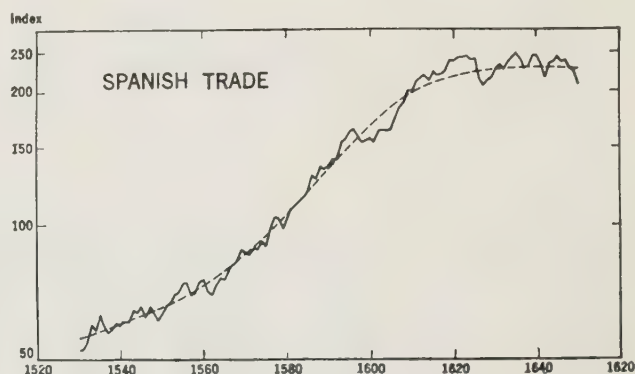


Fig. 6a. Index of Spanish Trade. **Ratio scale.**

Data 1530-1650, (After Davis and Hamilton), together with trend.

How has it worked out?

THE 6-YEAR CYCLE

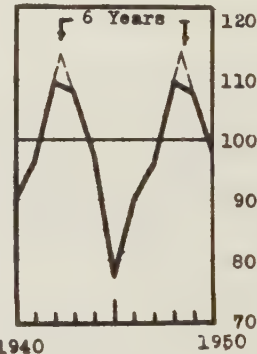
in the Sales of Armour and Company

In our report for December 1950 I gave you the results of a study of cycles in the dollar sales of Armour and Company for as far back as these figures are available.

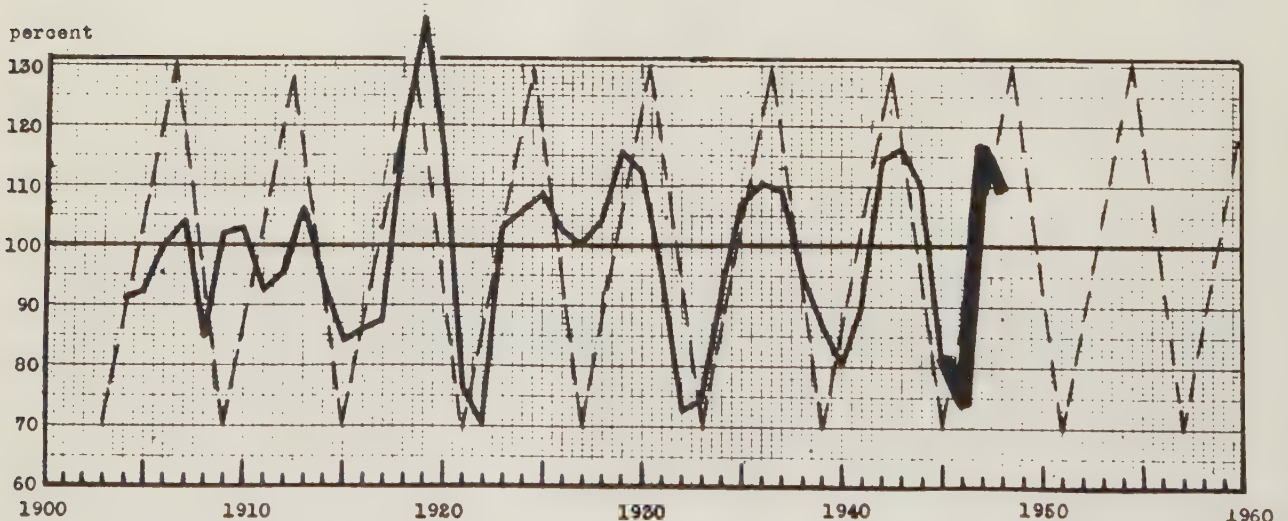
The chart presented showed you deviations from a six-year moving average. It indicated that the typical wave went down for $2\frac{1}{2}$ years, went up for $3\frac{1}{2}$ years, and crested ideally between 1948 and 1949. Typical amplitude was from about 78% of the moving average trend at the low to about 115% of the moving average trend at the high.

The question in your mind as you read the original report was doubtless, "Will this cycle continue?" The chart below shows that it did.

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Armour and Company. Dollar sales. Average wave based on seven cycles. Note that the typical cycle goes down for $2\frac{1}{2}$ years and up for $3\frac{1}{2}$ years. Crests come ideally between 1948 and 1949 and every six years forward and backward from that time.



Armour and Company. Dollar sales. Data expressed as percentages of their six-year moving average. Timing of typical six-year cycle shown by means of broken line. Heavy line from 1945 through 1948 shows how the behavior for these years conformed to the forecast. Note that the low in 1946 came one year late and that the high in 1947 came $1\frac{1}{2}$ years early. Note also that in both instances the amplitude was slightly more than average. Curve ends in 1948. A six-year moving average loses three years. Figures courtesy Armour & Company.

THE 6-YEAR CYCLE

in the Sales of the Pittsburgh Plate Glass Company

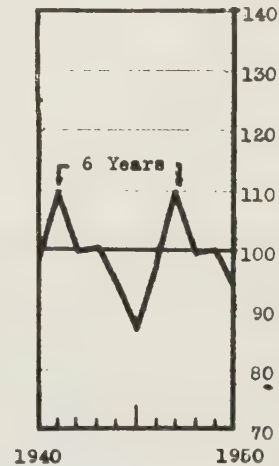
On page 10 of our report for December 1950 I printed for you a chart showing the 6-year cycle in the net dollar sales of the Pittsburgh Plate Glass Company.

The chart showed the percentages that the sales for each year were of their centered 6-year moving average.

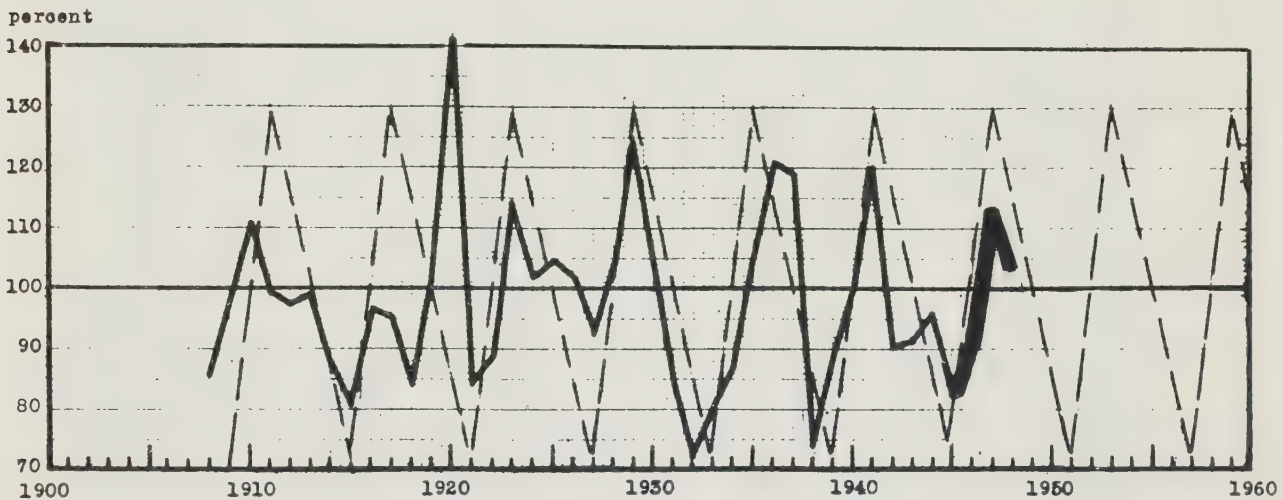
As a moving average loses three values at each end of the series and as the last figures in my possession at the time were for the year 1948 the last point on the chart represented the percentage for 1945.

The Pittsburgh Plate Glass Company has been kind enough to supply us with the figures of their net dollar sales for 1949, 1950, and 1951. With these figures in my possession I am able to extend the moving average through 1948 and to give you three additional points on the chart. These points have been connected by a heavy line so that you can see more readily the way in which the forecast came out. It is interesting to note that the crest of the last wave came exactly when forecast and that it was very close to typical amplitude.

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Pittsburgh Plate Glass Company. Net dollar sales. Average wave based on six cycles. Note that the typical cycle goes down for four years and up for two years. Crests come ideally in 1947 and every six years forward and backward from that date.



Pittsburgh Plate Glass Company. Net dollar sales. Data expressed as percentages of their six-year moving average. Timing of typical six-year cycle shown by means of broken line. Heavy line from 1945 through 1948 shows how the behavior for these years conformed to the forecast. Note that the low in 1945 and that the high in 1947 both came exactly in accordance with the forecast and that both low and high were of about typical amplitude. Curve ends in 1948. A six-year moving average loses three years.

THE 9.6-YEAR CYCLE

in Lynx Abundance

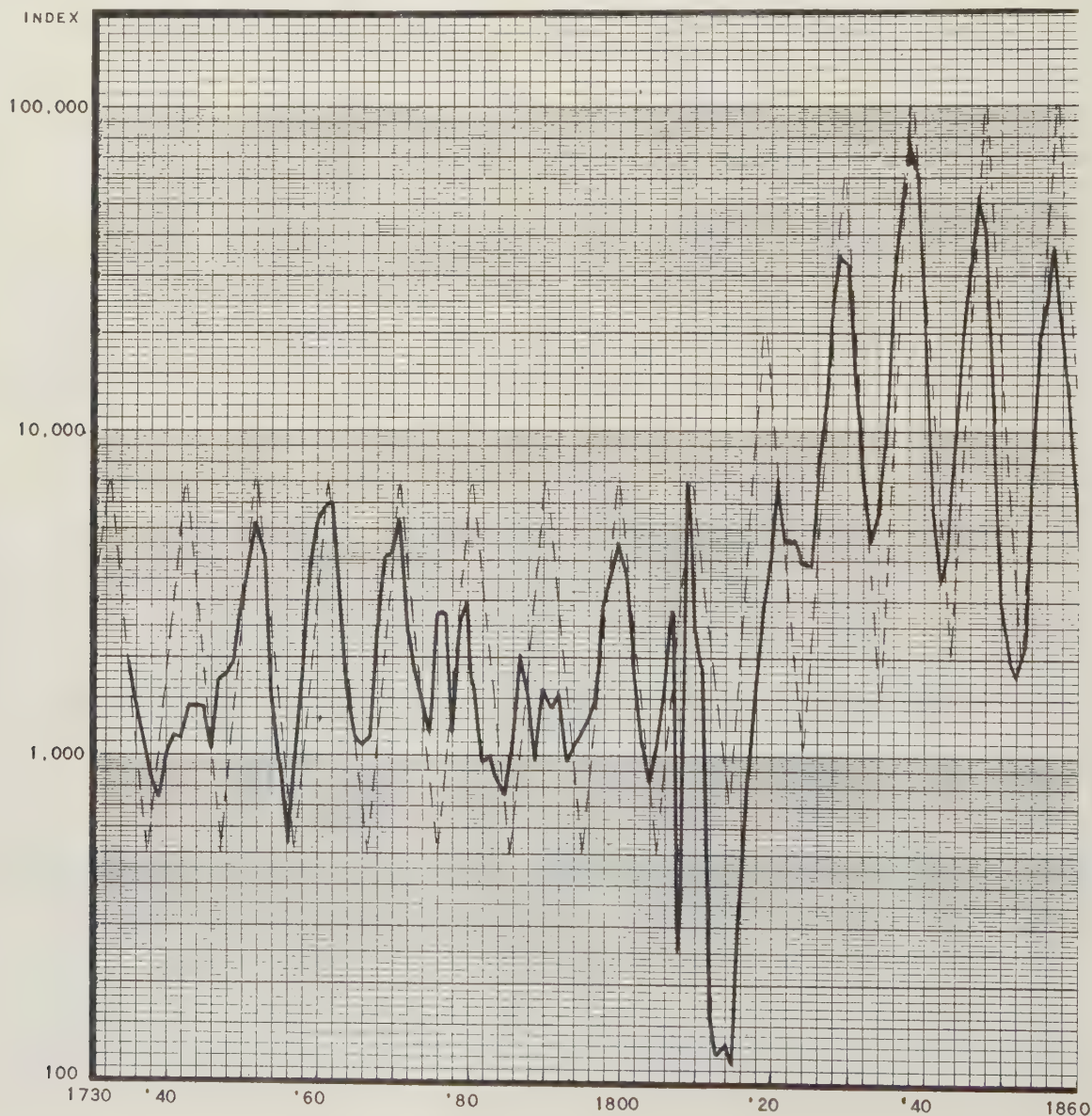
My original studies of the lynx cycle were based on figures of the catch from 1844 to 1904, earlier and later figures not being available to me at that time.

It is interesting to note the behavior of these figures from 1904 to date because, since my original work, $4\frac{1}{2}$ additional cycles have unfolded. The behavior since 1904 is indicated on Fig. 1 below by a

heavy black line.

It is also interesting to note the behavior prior to 1844.

By rights this earlier section of the curve should be shown by a heavy black line just like the section from 1904 to date, because the fulfillment of a projection rearward is almost as convincing as a projection forward.



In my original study I estimated the length of this cycle to be 9.75 years long. With the additional figures it was easy to see that the cycle was about $1\frac{1}{2}\%$ shorter or 9.6 years long. The broken zigzag in Fig. 1 shows the revised length.

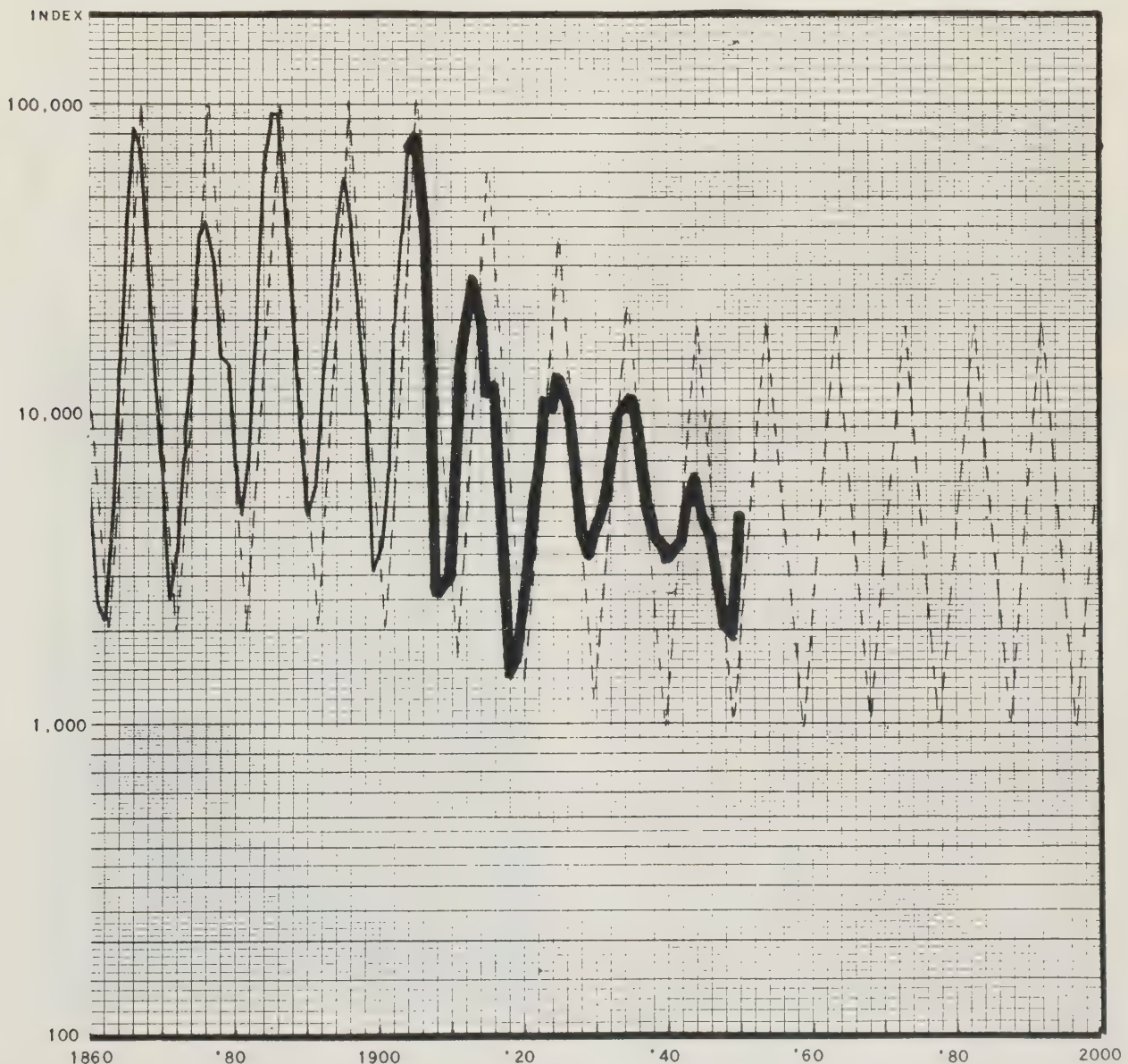
An index of lynx abundance, 1735—1948, was printed on page 12 of our report for October 1950. Figures by outfits from 1949 to date are given below. An outfit is a fiscal year beginning June 1 and ending the following May 31, or, from 1940 to date, beginning July 1st & ending June 30.

Thus, the figures given for outfit 1949 are really for the fiscal year ending June 30, 1950 and so on.

Table 1.

Outfit	Index
1949	1,849
1950	4,786

Figures are from the Department of Statistics, Canadian Government, and represent total collection of lynx furs times .4953 to make them comparable with the figures used earlier. erd



Foundation Affairs

JOHN Q. STEWART BECOMES A DIRECTOR

It is a great pleasure to announce the election of John Q. Stewart, Professor of Astronomy and Physics at Princeton University, as a Director of the Foundation for the Study of Cycles. Dr. Stewart is a person of great vision and originality of mind.

Professor Stewart was born in Harrisburg, Pennsylvania. He was educated in the public schools of that city and at Princeton University (B.S. 1915, Ph.D. in physics 1919). He was 1st Lieutenant in the Engineer Reserve Corps, 1917—1919, with combat service in sound and flash ranging, and engineer in the Development and Research Department of American Telephone and Telegraph Company for the period 1919—1921. Since September 1921 he has been on the faculty of Princeton University in the Department of Astronomy.

Professor Stewart has published research contributions in magnetism, theory of speech, physical optics, opacity of gases, general physical theory, solar and stellar atmospheres, sunspot cycles, solar eclipses, radio astronomy, hurricanes, weather cycles, marine and air navigation, etc. From a freighter in the Pacific he observed the longest total solar eclipse ever watched by astronomers (over seven minutes), June 1937.

For the past five years Dr. Stewart has devoted his principal attention to social physics, by which is meant such physical factors in social phenomena as distance, matériel, the numbers of people, their wants and satisfactions and levels of living, and the transfer to the social field of the methods and principles of physical science. Dr. Stewart is Secretary of the Committee for Social Physics of the A.A.A.S.

Social physics and the study of cycles overlap. Insofar as cycle study is concerned with social phenomena, it is a branch of social physics. But social physics includes much more than cycle study—and the study of cycles, on its part, extends far beyond the field of sociology.

The Foundation is particularly fortunate in having, through Dr. Stewart, a link with this new science.



John Q. Stewart

Letters

Dear Mr. Dewey:

On January 9, 1950, and January 6, 1951, I wrote you regarding observations I had made with respect to a 46-month cycle in the movement of stock market prices. I thought that the enclosed article* from the June 30th issue of Barron's might be of interest to you since it covers rather briefly a report of the discovery of this cycle and the indications that a bull market high will be reached in 1952, with a bear market low following into 1953.

The 46-Month Cycle

In my January 1950 letter I suggested the possibility that, with all due respect to the work of Kitchin and Jevons in other economic series, the 41-month cycle in stock prices might not be a true cycle. The substantiation of the 46-month rhythm for a period of 119 years from 1834, which has correctly anticipated 59 bull and bear markets out of the 61 movements of the cycle since that time, for an accuracy rating of 97%, can not be treated lightly. The practically uninterrupted record of the 46-month cycle for over 100 years, together with the failure of the 41-month rhythm in recent years, leads me to believe that the 46-month periodicity should replace the 41-month rhythm in cyclical studies of common stock prices.

Cycles in Raw Data Better

With respect to cycle analysis, I would like to take this occasion to express my views on that subject. I have a feeling that there may be a number of other tyros in the field of cycles who, like myself, are not completely satisfied with data presented in support of a cycle which is based on a "moving" something or other. In most instances this results in leaving you hanging in mid-air as to where the actual data are at the present time in relation to the projected cycle highs and lows. I want to know currently where we are, rather

*See pages 265 and 266 of this report.

than to learn at some future date where we were.

Also, while I am an exponent of the value of charts, I feel that some charts can be termed simply as "pretty" and have no practical application. For that reason I chose to present the statistical evidence of the 46-month cycle in tabular form which shows this rhythm clearly on the basis of unadjusted raw data, with the percent of appreciation and depreciation in each movement.

Clues Wanted

These views are intended to be purely constructive, not to be construed as a degradation of the work of anyone, for we certainly need all the assistance that we can get from everyone in exploring this vast field of cycle research. My hope is that others who feel as I do may be encouraged to join the pursuit of the "missing cycle," whether or not they follow a prescribed pattern of cycle analysis. I think that more might be done to promote this thought in the monthly publication of Cycles. The faintest hint of a clue from any member of the Foundation might lead to an important discovery by another.

I would appreciate greatly your very frank comments with respect to the case presented for the 46-month cycle. I realize fully that the test is now at hand as the cycle reaches its high this year and moves down into 1953. The next 12-18 months will reveal whether this indicated cycle has continued to live up to its previous performances.

Yours truly
Veryl L. Dunbar

Cincinnati 8, Ohio

I answered Mr. Dunbar as follows:

Dear Mr. Dunbar:

I agree with you that the 46-month rhythm in common stock prices cannot be treated lightly.

The 46-Month Cycle Well Substantiated

You will note that in addition to your own conclusive presentation, this cycle appears very importantly in the periodogram of industrial common stock prices, 1871—1950 on page 166 of our May 1952 report. It also appears in the periodogram of railroad stock prices, 1831—1950 on page 126 of our April 1952 report.

My own preliminary work done in 1944, reported upon on page 129 of the April 1952 report, and on page 88 for the report for March 1951, showed this cycle to be 45.5 months in length. The harmonic analysis indicated this cycle to be about 46.4 months. Your own approximation of 46 months falls midway between these two values and may indeed be the true length.

I have deep sympathy for your desire to know currently where we are and to get additional light on where we are going to be. This is possible with dominant cycles such as the 46-month cycle that you discuss in your paper.

Minor Cycles Sometimes Misleading

However, when we deal with minor cycles it is often misleading to emphasize where we are. Suppose, for example, we are in a major bull movement where prices are advancing at the rate of 3% a month. Suppose that simultaneously we are at the crest of a little minor wave which is due to go down for two months at the rate of 1% a month. The effect of this little minor wave will be to check the advance from 3% to 2% for the next two months (and then to speed it up to 4% for the two months next following). It would be a disservice to interested persons to emphasize the fact that the little wave was about to go down when the effect of this downward move would be merely to dampen the general rate of advance.

I agree with you also that some charts have no direct practical application. However, some cycles are so obscured by other factors that they cannot be seen easily in the raw data. That, however, is not the case with your 46-month cycle. I wish that you had charted raw stock prices from the beginning with a zigzag diagram showing your various highs and lows. I would like to publish such a diagram as a supplement to your article.

Mutual Help Required

I also share your hope that our monthly report may be used to publicize to all members of the Foundation clues that might be of help to them. Along this line, you will note Mr. Stokes' observations in regard to a 17.3-year repetitive pattern in the stock market. Also, you may have noticed my observations on what made the Benner forecast tick, on page 93 of the report for March 1952, suggesting a possible cycle $1/7$ of 27 years in length (46.28 months). The presence of this cycle might be one of the reasons for Benner's spectacular success. I think we should have much more of this sort of thing and hope that your letter will encourage all workers to send in any observations that they may have made.

You asked for my frank comments in regard to the case presented for the 46-month cycle.

The 46-Month Cycle Convincing

I find it very convincing. There seems to be no question but that there has been a cycle of about this length in stock prices for over 100 years and that it is unreasonable to ignore the possibility that it may continue.

I think the importance of this cycle is enhanced by the concurrent presence of a cycle of about half this length and another cycle of about $1/3$ of this length, in phase with the 46-month cycle, as far as lows are concerned, over the past hundred years. If these 23- and 15-month cycles are exact harmonics of the 46-month cycle, and if they all continue, we can expect the behavior you have observed to continue indefinitely. On the other hand, if these other cycles are almost-harmonics instead of exact harmonics they may ultimately get out of step with the 46-month cycle. I therefore think it would be desirable to isolate the 15-month, 23-month, and the 46-month cycles separately, and to project into the future a compound curve based upon what seems to be its three component parts.

I agree with you that the next 12 to 18 months will reveal whether or not this indicated cycle has continued to live up to its previous performances, but no matter what happens I do not feel that the next

12 to 18 months will be conclusive.

In other words, one more successful fulfillment of this cycle will not be final although it will be corroborative evidence of its reality.

On the other hand, one failure of a cycle that has dominated so consistently over so long a period of time should not be taken as final either.

I think the evidence you have presented in favor of this cycle is sufficient so that the cycle can stand on its own feet regardless of its behavior during any particular wave.

Please let me know if we may republish your Barron's article and if we may publish your letter and my reply.

Very cordially yours,



Gentlemen:

I have received the April, May, and June numbers of the magazine, *Cycles*. They brought to mind some byegone ideas and work that I did.

Many years ago I read in one of the numbers of *Science* that a cold winter that we had had was due to the presence of maximum sunspots. This idea fascinated me, and I thought, perhaps, that our Florida freezes might have taken place when the sunspots were at a maximum. I secured the sunspot tables as published, I believe, by the Weather Bureau and obtained from some German astronomer. I plotted these for more than 100 years. After this was done, I placed a mark where the various and most important freezes took place. With the exception of the freeze of 1875, these always took place at the period when the sunspots were present in maximum numbers. There were so few data, however, on the 1875 freeze that I don't know that it would qualify as a major disaster.

According to the way I figure it, last year was the time of maximum sunspots. Accordingly, we should either have had a freeze two years ago; last year, or we should have one next year. We have had no freezes the last two years, so I look

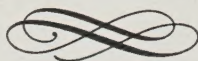
forward with more or less terror to next season.

Frankly, I do not know what good it would do to know either the day or the hour when a major freeze would take place. It would be just something more to worry about, but at the same time, I still believe in obtaining as much information about the world in which we live as possible.

When I was in the Hawaiian Islands, we were traveling on the road around the big island. The lava flows are marked with the year in which they took place. I noticed that each one of them took place at a period of maximum sunspots. We called on Dr. Jagar, the volcanologist, and I told him of my observation. He looked with absolute amazement upon a more entomologist who would make such an observation. His only reply was, "We do not understand the effect of kinetic energy on either the earth or volcanoes." I presume this idea has been brought out by astronomers and volcanologists many times, but I got a great satisfaction out of having observed it, myself.

Yours truly,
W. W. Yothers

Orlando, Florida



Additions to the Library

"Cycle Dominance Among the Fraser Sockeye," by William E. Ricker, reprinted from *Ecology*, Vol. 31, No. 1, January 1950, 26 pages, two tables, one figure, appendix, and literature cited. Gift of the Fisheries Research Board of Canada.

Dr. Ricker is Professor of Geology and Director of Lake and Streams Survey, Indiana University.

His paper discusses the four-year cycle in the abundance of the Pacific coast salmon.

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"The Current Status of Dynamic Stability Theory," by Frank E. Bothwell, *Communications and Electronics*, July 1952, published by the American Institute of Electrical Engineers, six pages, eight figures, references. Gift of Mr. W. D. Chandler.

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"Planetary Position Effect on Short-Wave Signal Quality," by John H. Nelson, presented before AIEE, New York, January 24, 1952, 4 pages, 2 figures. Gift of the author.

Mr. Nelson is Propagation Analyst of RCA Communications, Inc., and a Foundation gold medalist.

This paper deal with an observed planetary effect upon the variations in quality noted on transatlantic shortwave signals. Correlation over a seven year period discloses that certain planetary arrangements show good agreement with shortwave signal behavior. This should be looked upon as a new approach to an as yet unsolved problem.

I imagine that Mr. Nelson would be glad to send copies of this paper to other members of the Foundation, while the supply lasts. Address him c/o Office of the Vice President, BCC Communications, Inc., 66 Broad Street, New York, New York.

Mr. Nelson also has some mimeographed copies of an earlier draft of this paper containing 10 charts he might send you.

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"Population Cycles and Random Oscillations," by LaMont C. Cole, reprinted from *The Journal of Wildlife Management*, Vol. 15, No. 3, July 1951, 20 pages, one figure, six tables, references. Gift of the author.

Dr. Cole is Assistant Professor of Zoology at Cornell University.

In this paper Cole compares cycle lengths found in figures of tree ring widths, animal abundance, and random numbers, and finds that most of the population cycle data show greater variability in the cycle lengths than would be expected if the populations fluctuated entirely at random.

In the opinion of this reviewer Cole's work is made largely meaningless by the fact that he defines a peak as "any year in which the population exceeds that of the two adjacent years" and, presumably, the length of the cycle as the time interval between peaks so defined.

However Cole performs a valuable service in again calling attention to the fact that rhythmic cycles can exist as a result of random forces (for example, "an automobile traveling along a bumpy road where the car body describes fairly regular up and down movements with the period determined by inherent properties of the system (load, springs, shock absorbers) rather than by the disturbing stimuli (bumps) which need not possess any precise regularity").

Also Cole is to be commended for emphasizing that rhythmic cycles can exist in random numbers, and that in any series of figures it is very hard, (and, unless the series is long enough, often impos-

sible) to tell the probability of observed cycles being random or "real."

Too many people fail to recognize that in cycle study as in other areas, all that glitters may not be gold.

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"Pig Iron Prices Due to Rise," author unknown, **The Industrial Digest**, November 1924, 10 pages, 12 charts. Gift of Mr. Charles G. Tufts.

For comments see page 277 of this report.

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The Electrical Factor in Metabolism, by W. N. Abbott, Vol. 2, first edition, The Commercial Printing Company, Limited, Wellington, 452 pages, appendix, 117 figures. Gift of Dr. Abbott.

This book, as the title indicates, is largely concerned with the electrical factor in metabolism. The chief reference to cycles, as such, is an attempt to relate epidemics of poliomyelitis in New

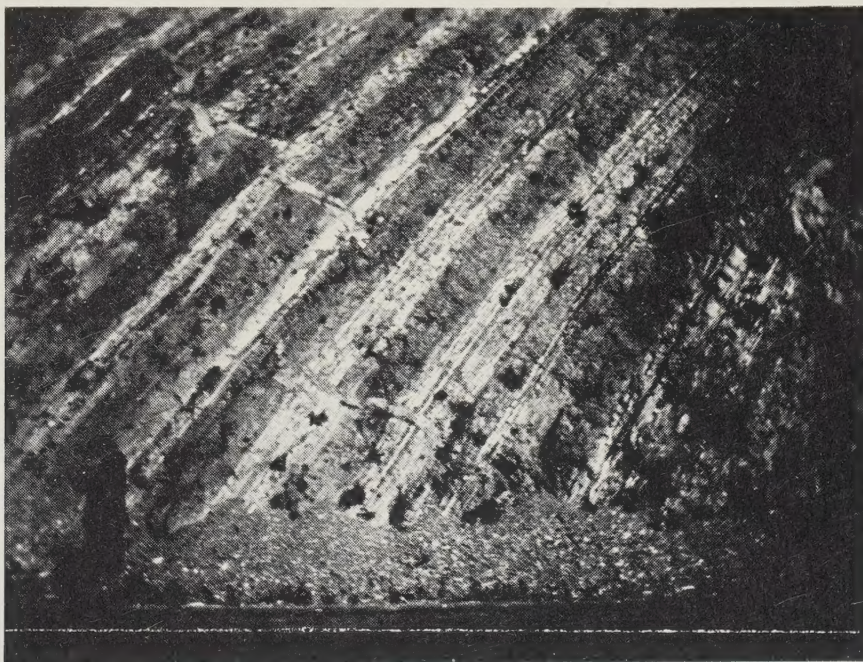
Zealand and Australia with the sunspot curve. Charts are shown illustrating the incidence of polio in New Zealand from 1915 through 1949 and for Australia from 1927 through 1949, together with curves of sunspot numbers.

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"More on Weather Cycles and Their Causes," by Halbert P. Gillette, reprinted from March 1952 issue of **Water and Sewage Works**, three pages, two figures. Gift of the author.

In this article Mr. Gillette discusses 336- and 672-year weather cycles. He believes that Professor Nishioka's 700-year cycle in tree ring growth in Japan, discussed in our November report, may be another manifestation of the 672-year cycle he has observed in variations of composition in rock strata (see photograph).

Copies of this paper are doubtless free on request, while the supply lasts. Address Halbert P. Gillette, San Marino, California.



Paired Beds of Calcareous and Argillaceous Mudstone that Record the
672 Year Climatic Cycle

Mr. H. A. Musham
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Chicago, Ill.